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THE EFFECT OF FOREIGN DIRECT INVESTMENT AND MULTINATIONAL CORPORATIONS ON SUSTAINABLE DEVELOPMENT IN NIGERIA: HALO OR HAVEN? EMPHASIS ON CO_2 ANTHROPOGENIC EMISSION

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ABSTRACT

Although data on single-country environmental indicators exist in short-span leading to the use of cross-section or panel data by most related studies, there has been attempts to understand country-specific analysis of FDI-Environment nexus. This study explores the relationship between FDI and the operations of Multinational Corporations (MNCs) on sustainable development in Nigeria- the major destination for FDI inflow to West Africa. Using CO_2 emission as the measure of environmental degradation, we employ annual data spanning from 1970 through 2005 to investigate whether the "pollution haven" or "pollution halo" scenario holds in Nigeria. By applying the Autoregressive Distributed Lag (ARDL) approach to cointegration to examine the nature of the relationship, we found that FDI is negatively related to CO_2 emission. This suggests a scenario of "pollution halo"; implying that if CO_2 is considered a measure of environmental degradation, more FDI inflow is beneficial and compatible with sustainable development since we found no evidence for "pollution haven" for the aggregate FDI inflows to all sectors. We suggest future research in this area to employ sector-specific data on FDI inflow so that a direct delineation could be made between the environment-degenerating and environment-benign destinations of FDI inflows to Nigeria. Besides, other measures of environmental quality such as water pollution and the destruction to aquatic habitat, most especially in the South-South region of Nigeria, could also be explored since the result from this study may not be generalized for other measures of environmental quality (Deacon and Norman, 2006). The unique contribution of this study lies in the fact that, it is the first single-country focused study to examine FDI-Environment nexus for the case of Nigeria.

Keyword**s**; Sustainable development, FDI, Pollution.

INTRODUCTION

Nigeria had consistently remained the major destination for FDI inflow to West Africa[i]. Whether or not, there is a relationship between the nature of the FDI inflow and environmental degradation, is unclear. However, environmental regulations are most often, not as strict in developing countries compared to their developed counterparts, Abdul-Gafaru (2006). The laxity-to-openness or restrictiveness-to-openness attribute of trade and investment policies greatly determines the extent to which a host-country benefits from FDI and the operations of MNCs. The laxity in environmental regulation had accounted for enormous destruction to Nigeria's ecosystems. In 1999, the U.N. dubbed the Niger delta- where the oil deposits are found, the "most threatened" in the world. It is logical to expect such since the framework for environmental policy is relatively new in Nigeria (Makinde and Adeyoke, 2007). Her oil production is reported to have contributed immensely to global warming and the danger of climate change through the flare of natural gas, to the tune of 23 billion cubic meters, yearly. This amounts to a yearly emission estimate of 400 million tons of carbon dioxide equivalents[ii].

To attenuate the destruction to the ecosystem ensuing from anthropogenic pollution, among others, the World Commission on Environment and Development (WCED) had since 1987 recommended countries to follow the path of sustainable development (SD). This will not only ensure rapid economic growth but also the conservation of the environment within the context of a "growing economy". SD balances between the economy and the environment. Unfortunately, this has been ignored by the major studies that have investigated the impact of FDI on economic growth in Nigeria (e.g Nwafor, Ferdinand (2007), Olomola, Philip Akanni (2004), Akinlo, A. Enisan (2004), among others).

Sequel to the foregoing, in Nigeria's pursuance to harness her potentials for development, consideration has to be given to some crucial issues. Such issues do not only relate to the country's economic, social and political conditions, emphasized by Risikat (2007), but also, what Aliyu (2005) dubbed "Dirty" FDI (i.e. intensively polluting industries) in host countries. CO2[iii] (a greenhouse gas) pollution constitute one of such environment-degenerating activities. Such anthropogenic pollution intensity of MNCs should be considered before deciding on the choice of the investment and trade policy regime to adopt. The pursuance of such objective conforms to goal-7 of September 2000 UN Millennium Summit declaration, which accentuates on the reduction of Carbon dioxide pollution as a development goal [iv]to be achieved by 2015 in response to the world's major development challenges.

Hence, since "Dirty" FDI exist as underscored in Aliyu (2005) and Abdul-Gafaru (2006), the proposal by New Partnership for Africa's Development (NEPAD) and Business and Industry Advisory Committee to the OECD (BIAC) (1999), that unrestrained inflow of FDI would aid the attainment of development and environmental sustainability (ES) becomes unclear. This is because, the experiences of different nations differ, as to how FDI and MNCs have contributed to the development process in host countries.

While empirical evidence are mixed on the impact of FDI on host economy's ecological environment, theoretical explanations proffered so far, also reveal some element of vagueness. For instance, many country-specific and cross-country empirical studies of the relationship between FDI-environment like Talukdar and Meisner (2001), Zeng and Eastin (2007) and Blackman and Wu (1998) found evidence for 'pollution halo'. Others such as Merican et al., (2007) found mixed results. However, Aliyu (2005) found evidence for a 'pollution haven' scenario in developing countries. This contentious issue is best appreciated when viewed from the perspectives of the environmentalists and neoliberal theorists.

Neoliberal theorists emphasize the importance of FDI/MNCs by pointing to the aids it offers host countries in their developmental process through the transfer of capital, cleaner-technology and other forms of spillovers. It is therefore, contended that MNCs employ clean management practices similar to those employed in their country-of-origin (developed countries). The rationale for such is that modern technologies which encourage environmental conservation through reduction in pollution arising from green consumers' pressures in the developed countries are transferred or imported to the subsidiary companies operating in developing countries. As such, MNCs enhance "pollution halos" (Aseem and Matthew 2006: 3; Pauly and Reich 1997:1; Zeng and Eastin 2007: 991; Prakash and Elango 1999:292). Countries most often cited as beneficiaries in this context are the newly industrialized countries of Hong Kong, Taiwan, Singapore, South Korea and fairly recently, China. These countries have all recorded impressive economic growth by opening their economies to the flow of foreign capital (Kebonang, 2006). Therefore, in terms of SD, the neoliberal theorists posit that MNCs are important catalyst of ES.

On the contrary however, the dependency theorists and environmentalists alike have a contrary view (Kebonang, 2006; Abdul-gafaru, 2006; Merican et al., 2007). They contend that economic openness in the context of FDI may not always be beneficial or optimal for a nation but the reality, they assert, becomes elusive. This is because, attentions have been turned away from the relationship between 'economic openness and the ecosystem' (Reuveny, 2001; WWF, 2003). This emphasizes the implications of the arguments advanced against FDI and MNCs by the dependency theorists who pout that "bad technology" is transferred to the developing countries through FDI and MNCs.

Therefore, advocates of economic openness-for-perpetual-economic-growth implicitly assume the ecosystem can support all kinds of growth. Meanwhile, supported by the first and second laws of thermodynamics, nature's capacity to absorb and or convert pollutants ensuing from economic activities as the economy grows, most especially from "dirty FDI", is limited (Callan and Janet, 2004). This explains the reason why urban smog is severe in cities like Los Angeles and the city of Mexico. They emphasize putting the environment into perspective by giving it the due consideration of ensuring its long-term quality and abundance while pursuing economic growth (Council on Environmental Quality, 1993). Hence, the arguments proffered by both schools render the theory somewhat vague as a guide to policy in determining whether or not, FDI and the operation of MNCs are compatible with SD in developing host-country's economy.

The present study attempts to investigate whether or not, the pace of Nigeria's economic integration through FDI inflows, as depicted in figure 1, has been healthy to the economy in the contexts of the preservation of her ecosystems since 1970. This is because, there exist a lingering argument as to whether or not, FDI inflow is compatible with SD in Nigeria. While Moffat and Lindén (1995)[v] pout that there is little evidence of widespread contamination from MNCs operating in Nigeria's petroleum sector, the Environmental Rights Action (2008), contends that those MNCs are the major culprits for the pollution of land and air. This calls for empirical analysis. Unfortunately, not much empirical work has been done to investigate whether or not, there is evidence to suggest that FDI inflow in Nigeria is compatible with SD since most studies such as Ngozi et al (2007), Nwafor (2007), Olomola (2004), Akinlo and Enisan (2004) which explore the impact of FDI in Nigeria have only investigated its impact on growth.

The remainder of this paper is structured in the following order. In Section 2, the methodology is set forth. Empirical analyses and findings from the relevant data are presented in Section 3. Finally, Section 4 concludes.

METHODOLOGY

CO2 is used as a proxy for environmental quality and is deemed fit as its reduction has taken a central theme in international treaties on climate change and global warming (IPCC, 1996; Kyoto Protocol, 2005). This is because, anthropogenic CO2 emission accounts potentially for 82 per cent of 'global warming' (Sadullah & Pinar, 2009; and Eurostat, 2008). Profoundly linked to such is that, the Nigerian government aims under its millennium development goals, to reduce her CO2 emission (Igbuzor, 2005).

A survey through the literature suggests a number of possible determinants for anthropogenic CO2 emission. However, we adopt those of Talukdar and Meisner (2001) and kahuthu (2005) as modified by Merican et al (2007). We further adjusted the model to take into consideration the primary sector production. This is because, it is perceived the most pollution intensive category of economic activity in developing countries (Panayotou, 1997). The relevant model thus, becomes:

$$\ln E_t = \alpha_0 + \alpha_1 \ln GNIPC_t + \alpha_2 \ln FDI_t + \alpha_3 \ln AUFF_t + \varepsilon_t$$

Where; $E_{t,}$ is the variable for environmental degradation, in our case, CO2 emission (in metric ton per capita), α_0 is the intercept term. ε_t represents the white noise error term and GNIPC, represents Gross National Income per capita. AUFF, which represents the value-added by economic activity in Agriculture, hunting, forestry and fishing is our proxy for primary sector production. We expect positive signs for α_1 and $\alpha_{3.}$ However, α_3 could be positively or negatively signed depending on the tenability of whether the neo-liberal or Environmentalists contention.

Data Description

Although most empirical studies have employed cross-country or panel data for empirical estimations in understanding the nature of environment-economy relationship, especially, in the EKC literature. However, the use of such type of data has been fiercely criticized (Egli, 2004; Roberts and Grimes, 1997), leading to a justification for studying single-country time series.

Since FDI flows infrequently during the course of a year, annual data, as employed in this study, is traditionally used. The study covers the period from 1970 to 2005. It starts from 1970 due to data unavailability for some of the variables prior to 1970. Likewise, the years considered ends in 2005 on account of lack of data for some of the variables beyond 2005. For all data sets used in this study, table 1 shows the variable acronyms, together with their definition, measure and sources.

Estimation Technique

Since this study employs the use of time series data which are found to have different orders of integration, the traditional maximum likelihood method, based on Johansen and Juselius (1990) and Johansen (1991) approach can not be used to investigate the long run relationship (cointegration) between CO2 and the explanatory variables in the model. This is to prevent spurious regression. To obtain reliable results, we instead, use the autoregressive distributed lag modeling approach (ARDL) by Pesaran and Shin (1995) and Pesaran et. al, (1996, 2001). This is because, the ARDL approach can accommodate such heterogeneity in variables' integration order so far as the dependent variable mimics I (1) process and that no variable is I (2). This saves us the rigor of having to put up with different unit root tests yielding different orders of integration. Moreover, ARDL approach integrates the short-run dynamics with the long-run equilibrium without losing long-run information and it takes sufficient numbers of lags to capture the data generating process in a general-to-specific modeling framework (Shrestha, 2005).

Following Pesaran *et al*. (2001), the relevant ARDL error correction representations corresponding to our can be stated as[vi];

$$\Delta \ln E_t = C_0 + \beta_1 \ln E_{t-1} + \beta_2 \ln GNIPC_{t-1} + \beta_3 \ln FDI_{t-1} + \beta_4 \ln AUFF_{t-1}$$
$$+ \sum_{i=1}^{\rho} \phi_1 \Delta \ln E_{t-i} + \sum_{i=0}^{q} \phi_2 \Delta \ln GNIPC_{t-i} + \sum_{i=0}^{r} \Delta \phi_3 \ln FDI_{t-i}$$
$$+ \sum_{i=0}^{s} \phi_4 \Delta \ln AUFF_{t-i} + \varepsilon_t$$

Where Δ represent first difference operator, β_i are the long-run multipliers, ϕ are short-run dynamic coefficients, ε_t are white noise errors and C_0 is the drift term.

The existence of long-run relationship is ascertained by conducting an F-test for the joint significance of the coefficients of the lagged values of the variables. This implies that we test the null hypothesis; H_N: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$ (no long-run relationship), against the alternative hypothesis H_A: $\beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq 0$ (a long-run relationship exists). The relevant F-test as approximated by Pesaran and Pesaran (1997) and Pesaran et al.(2001), has a non-standard distribution, contingent on (i) whether variables in the ARDL model are I(1) or I(0), (ii) the number of regressors, (iii) whether the ARDL model contains an intercept and or a trend (Narayan, 2004). Such F-test is suitable for investigating independent variables when I(d) is such that; $0 \leq d \leq 1$ (here, I(d) represents order of integration of the different series). In such circumstance, a lower value assumes the regressors are I(0) and an upper value assumes the regressors are purely I(1).

However, since the critical values provided by Pesaran and Pesaran (1997) and Pesaran et al., (2001), are suitable for large samples, we resort to the reformulation of those critical values for small sample size provided by Narayan (2004). This is more suitable given the small sample size of our observations. Under such case, the null hypothesis of no long-run relationship is rejected irrespective of the order of integration of the time series, if the F-statistic is above the upper critical value. Alternatively, if the F-statistic falls below the lower critical value, the null hypothesis can not be rejected. Finally, if the F-statistic falls in between the upper and lower critical bounds, the result is inconclusive.

In the second step, once the cointegration is established, the long-run ARDL model for E_t (CO2 emission) of the order (p,q, r, s), represented below, could then be estimated.

$$\ln E_t = \alpha_0 + \sum_{i=1}^{\rho} \beta_1 \ln E_{t-i} + \sum_{l=0}^{q} \beta_2 \ln GNIPC_{t-i} + \sum_{l=0}^{r} \beta_3 \ln FDI_{t-i}$$
$$+ \sum_{l=0}^{s} \beta_4 \ln AUFF_{t-i} + \varepsilon_t$$

Here, all variables are as previously defined. The process involves selecting the orders of the ARDL (p, q, r, s) in the four variables. In conducting this, we employ Akaike Information Criterion (AIC), as our model specification criterion. In the final stage, we find the short-run dynamic parameters through the estimation of the error correction model (ECM) associated with the long-run estimates. We specify the ECM as thus;

$$\Delta \ln E_t = \eta_0 + \sum_{i=1}^{\rho} \phi_1 \Delta \ln E_{t-i} + \sum_{i=0}^{q} \phi_2 \Delta \ln GNIPC_{t-i} + \sum_{i=0}^{r} \Delta \phi_3 \ln FDI_{t-i}$$
$$+ \sum_{i=0}^{s} \phi_4 \Delta \ln AUFF_{t-i} + \lambda ecm_{t-1} + \varepsilon_t$$

Where ϕ_1, ϕ_2, ϕ_3 and ϕ_4, are the short-run dynamic coefficients of the model's convergence to equilibrium and λ is the speed of adjustment.

ANALYSIS, FINDINGS AND DISCUSSION

Unit Root Tests

Prior to conducting the ARDL test, we investigate the stationarity status of the variables to ensure that the aforementioned requisite conditions are met. This does not undermine the assertion that ARDL modeling paves way for the avoidance of such pre-test investigation. Rather, the motive is to avoid a spurious result which might ensue from the inclusion of I(2) variables in the model since, the critical F-statistic provided by Pesaran et al (2001) is based on the assumption that the variables are either I(0) or I(1) process, (Ouattara, 2004). Moreover, we conduct the unit root test to ascertain that the dependent variable is I(1), which is a condition to be fulfilled, (Fosu & Magnus, 2006). Following Merican et al (2007), we employ the Augmented Dickey Fuller (ADF) and the Phillips-Perron (PP) unit-roots.

The unit-roots result as shown in table 2, relying on the ADF and the PP tests, indicate that none of the series of the included variables has I(2) order of integration or more and the dependent variable is found to mimic I(1) process. These satisfy the conditions for conducting ARDL modeling.

Bounds Test Cointegration Result

Guided by the general-to-specific method of choosing appropriate lag for the estimation, we base our choice of the appropriate lag length on F-statistic value as proposed by Bahmani-Oskooee & Ng (2002). In conformity to the procedure established by Pesaran & Pesaran (1997), we estimate an OLS regression for the first-differences parts of equations. Thereafter, the joint significance of the lagged level variables are tested using the two-bounds F-statistic distribution discussed earlier, to test the joint null hypothesis that, the coefficients of all lagged level variables are zero (implying the non-existence of a long-run relationship). E_t is taken as the dependent variable (i.e. the equation is normalized on E_t) in the ARDL-OLS regressions.

The relevant critical value bounds are based on case II with restricted intercept and no trend (Narayan, 2004). Such model does not conform to that used by Merican et al (2007), who used the critical value for case III with unrestricted intercept and no trend from Pesaran (2001). We have however, chosen case II purposefully because, the theory suggests that even at zero level of economic activities, there will be certain level of CO2 pollution which does not ensue from anthropogenic sources (i.e., by nature).

As evident in table 3, the calculated F-statistics is 4.2853 while the corresponding lower and upper bounds critical values are 2.957 and 4.2853, respectively. Obviously, the computed F-statistic exceeds its upper critical bound at 5% level of significance. This implies the existence of a long-run relationship between CO2 emission and its determinants. Hence, we reject the null hypothesis that: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$.

In the second step, we use the lag lengths specified in the first step, together with the AIC model specification criterion to estimate the long-run equation. Interestingly, AIC selects ARDL (1,0,1,0) specifications for the equation, yielding the estimated long-run equation presented below.

Estimated long run coefficients using the ARDL approach

ARDL (1,0,1,0) selected based on AIC. Where lnE_t is the dependent variable.

Regressor	Coefficient	Standard Error	T-Ratio	P-Value
C	-4.7515	0.13222	2.5506**	0.016
LGNIPC	0.33725	0.070724	-3.2157***	0.003
LFDI	-0.22743	0.37700	1.8929*	0.068
LAUFF	0.71362	1.6331	-2.9094***	0.007

***,**, * denote 1%, 5% & 10% significance level, respectively.

The estimated coefficients of the long-run relationship exhibited above, shows that, although FDI is statistically significant, it is negatively signed. The coefficient shows a that 1% increase in the degree or intensity of FDI inflows (i.e. FDI as a per cent of GDP) is followed by an approximately 0.23% reduction in CO2 emission. While the positive sign is expected from the environmentalist and dependency theorists' point of view, the negative sign for the degree of FDI inflows is expected from the neo-liberal and the neo-classicists' perspective.

Thus, it is clear from our analysis that, transnational corporations' presence, in aggregate terms, does not seem to aggravate pollution or environmental degradation (when the intensity of CO2 emission is used as a measure of environmental quality). Therefore, in respect of CO2 pollution, we found evidence in support of the assertion of the neo-classicists and neo-liberal theorists regarding the *pollution halo hypothesis* in developing FDI-host countries for the case of Nigeria.

Error Correction Model

Having ascertained the existence of long-run relationship among the variables in the second step; we proceed by estimating the ECM equation using the same lag length as in the previous tests based on AIC. Such representation is important because, it is the most efficient way of ascertaining cointegration (Bahmani-Oskooee, 2001; Kremers et al, 1992). The ECM result as reported in table 4 shows that the coefficient of the error correction term is negative and highly significant at 1%. This further establishes evidence for the existence of a long-run relationship among the variables included in the model. The negative ECM coefficient of -0.52087 indicates the speed of adjustment towards long-run equilibrium. This implies that, approximately 52% of disequilibrium from the previous year's shock converges back to the long-run equilibrium in the current year.

ARDL Model Diagnostic Tests

It is traditional to assess the reliability of a model by examining few diagnostic statistics. To this end, we investigate a number of diagnostic statistics related to the model. The results, as exhibited in table 5 show that overall, the model fits the data. This is evidenced by the high significance of F-statistic at 1% and the moderately high values of the R-square and R-Bar-square. No evidence of autocorrelation was found for the disturbance term, as shown by both the Durbin-Watson test value and the insignificance of the value given by Breusch-Godfrey LM test for autocorrelation. The model satisfies the Jarque-Bera normality test, indicating that the errors are normally distributed. Moreover, the Ramsey RESET test for functional form suggests that the model is correctly specified.

Besides, to ascertain that the estimated regression coefficients are not biased, we evaluate their stability across the period considered using both the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) tests for structural stability (Brown et al., 1975). As evident in Figures 3 and 4, we found that, the estimated parameters of the regression equation are stable since neither the CUSUM nor CUSUMSQ test statistics exceed the bounds at the 5% level of significance.

CONCLUSION

This study is perceived to be the first of its kind for the case of Nigeria. Its major objective was to investigate the FDI-Environment relationship. This is in a bid to examine whether 'pollution halos' or the 'pollution haven' hypothesis holds in Nigeria. Using time series data for the purpose of capturing country-specific peculiarities, we use the ARDL method of cointegration. Consistent with the findings of Blackman and Wu (1998), Talukdar and Meisner (2001), Zeng and Eastin (2007) and to a great extent, Merican et al., (2007), we found evidence for a 'pollution halo' scenario for CO2 emission in Nigeria.

Future research efforts on FDI-Environment nexus, most especially on Nigeria, could benefit enormously from our main findings. One way is to consider the use of sector-specific inflow of FDI so that delineation could be made between environment-degenerating and environment-benign destinations of FDI. Moreover, this study uses only CO2 as a measure of environmental sustainability. It should be noted that, while pollution halo was found for the case of CO2, such result might not be true with other measures of environmental quality. This is evident in Deacon and Norman (2006) where examining different pollutants yielded different results. We therefore suggest subsequent studies to consider other measures of environmental degradation in Nigeria, most especially, water pollution by oil refineries (the sector that had always attracted the largest share of FDI), loss to aquatic life and vegetation and deforestation.

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Figures

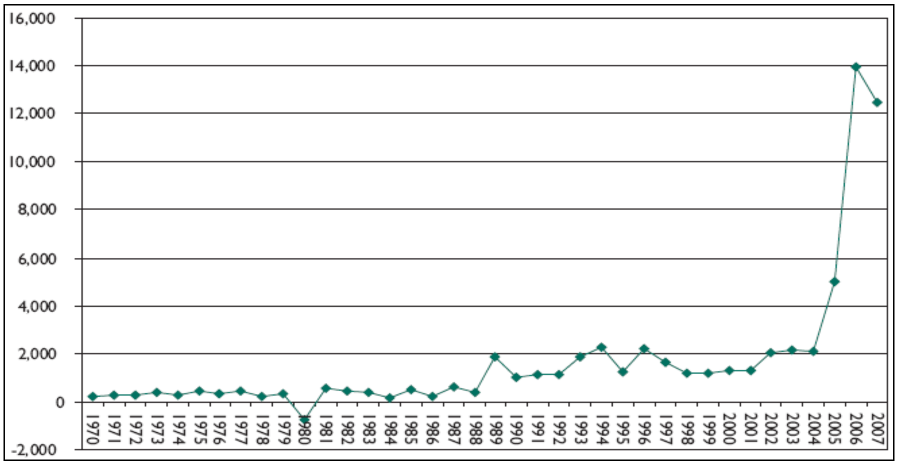

FIGURE 1: FDI Inflows to Nigeria 1970-2007
Source: UNCTAD FDI/TNC Database

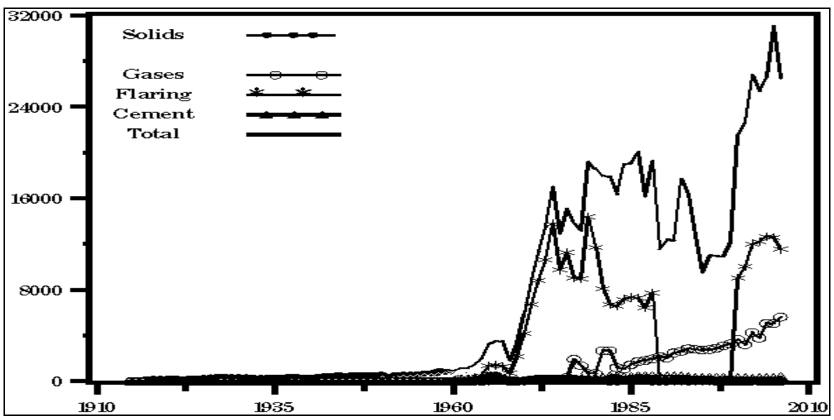

FIGURE 2: The Trend of CO2 Emission in Nigeria, 1910 – 2010 (‘000’ metric tons of Carbon).
Source: Carbon dioxide Information Analysis Center.

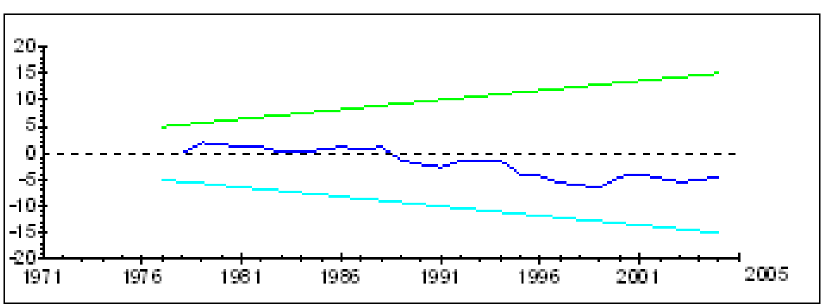

FIGURE 3: Plot of the Cumulative Sum of Recursive Residuals (CUSUM)
*The Straight lines Represent Critical Bounds at 5% Significance level

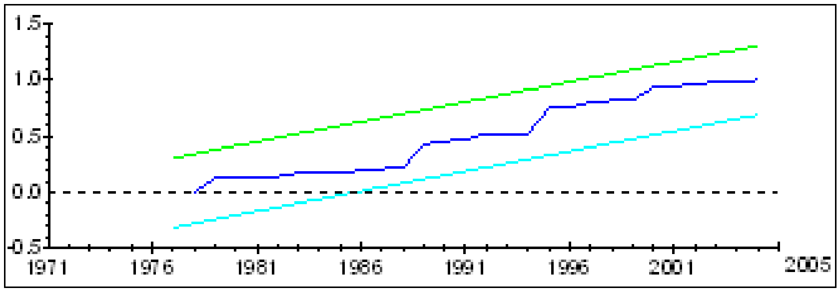

FIGURE 4: plot of the Cumulative Sum of Squares of RecursiveResiduals (CUSUMSQ)
*The Straight lines Represent Critical Bounds at 5% Significance level

TABLE 1: Variable Acronyms, their Definition and Source

Variables Acronyms	Definition	Measurement	Source
LE	Log of Per Capita Carbon dioxide Emission	Metric Tons of Carbon	World Bank, World Development Indicators (WDI) 2009 online database.
LGNIPC	Log of Gross National Income Per Capita	US Dollars	United Nations Statistical Division Online Database
LFDI	Log of Gross Foreign Direct Investment (Inflows) to Nigeria (National Currency)	Gross FDI as a Percent of Constant GDP (Nigerian Naira)	2005 Central Bank of Nigeria (CBN) Statistical Bulletin
GDP	Gross Domestic Product (National Currency)	Constant 1990 Prices (Nigerian Naira)	United Nations Statistical Division Online Database
LAUFF	Log of value-added in Agriculture, hunting, forestry & fishing.	Constant 1990 Prices (US Dollars)	United Nations Statistical Division Online Database

TABLE2: Results of the Augmented Dickey Fuller and Phillips-Perron Unit Root Tests

DIFFERENCE	**LEVEL**		**FIRST**	
	Without Trend	**With Trend**	**Without Trend**	**With Trend**
Augmented Dickey-Fuller				
LE	-2.092495	-2.584499	-6.127396***	-5.996883***
LGNIPC	-1.795747	-1.587603	-3.564031**	-3.476909*
FDI	-1.379173	-2.240698	-8.438778***	-8.313044***
MMU	-3.365691**	-3.139913	-6.380478***	-6.401553***
AUFF	-0.051994	-3.503744*	-5.841540***	-6.548963***
Phillips-Perron				
LE	-2.135235	-2.627891	-6.213277***	-6.074838***
LGNIPC	-1.787772	-1.891480	-3.564031**	-3.476909*
FDI	-5.380762***	-6.378765***	-16.72712***	-16.49799***
MMU	-3.437896**	-3.210910*	-6.431745***	-6.436912***
AUFF	-1.311277	-3.892917**	-5.481529***	-6.020107***

Note: ***, ** and * denote significant at the 1%, 5% and 10% significance levels, respectively.

TABLE 3: Results from bounds tests on equations

	Selected Lag Length	Computed F-Statistic	Probability	Critical-F Values I(0)	Critical-F Values I(1)	Bounds Test Outcome
ARDL-OLS Reg. Model **	1	4.2853	0.010	2.957	4.117	Cointegrated

Notes: Asymptotic critical value bounds are obtained from appendix A1, A2 & A3, Case II: restricted intercept and no trend for k=4 (Narayan 2004, p.26-28).** denotes 5% significance level.

TABLE 4: Error correction representation for the selected ARDL model

ARDL(1,0,1,0) selected based on AIC. Where $\Delta \ln E_t$ is the dependent variable.				
Regressor	Coefficient	Standard Error	T-Ratio	P-Value
C	-2.4749	0.88773	-2.7879***	0.009
ΔLGNIPC	0.17566	0.082037	2.1413**	0.040
ΔLFDI	-0.041278	0.035941	-1.1485	0.260
ΔLAUFF	0.37170	0.17879	2.0790**	0.046
ecm(-1)	-0.52087	0.12092	-4.3076***	0.000

Note: ***(**) denote 1% (5%), respectively.

TABLE 5: ARDL Model Diagnostic Tests

Diagnostic Tests:		
R^2	0.47165	
Adj. R^2	0.38056	
D-W	2.0712	
F-Statistic	6.4721***	
Test Statistics	LM Version	F Version
χ^2 *Auto*	0.12672	0.10175
χ^2 *Norm*	0.091361	Not applicable
χ^2 *Hetero*	1.2938	1.2667
χ^2 *RESET*	6.4960**	6.3811**

Note: While the F version implies the computed F-statistic, LM, denotes the corresponding lagrange multiplier values. D-W represents the Durbin-Watson test; Auto is the Breusch-Godfrey LM test for autocorrelation; Norm is the Jarque-Bera normality test; Hetero is the White test for heteroskedasticity; RESET is the Ramsey test for functional form. The significance levels **(***) denote 5% (1%), respectively.

END NOTES

[i] Figure 1 shows the trend of FDI inflows to Nigeria since 1970.
[ii] This emission figure is contained in 2008 Fact Sheet of the Environmental Rights Action/Friends of the Earth, Nigeria.
[iii] Figure 2 shows the trend of CO2 emission in Nigeria by sources.
[iv] The declaration was the outcome of the world “most attended” gathering by heads of states. Espoused by 189 nations, the gathering came up with an-eight-goal millennium declaration”, called the millennium development goals (MDGs).
[v] This information could be found in Nigeria’s Environmental Profile at www. Mongabay.com
[vi] For more details on the mathematical derivations that underlie this error correction representation, see Pesaran et al (2001).